BABU BANARASI DAS UNIVERSITY

LUCKNOW

Session : 2025-2026

SCHOOL OF COMPUTER APPLICATIONS

PROJECT

NO SQL and DBaas 101 (NO SQL)

(BCADSN13202)

Submitted By:-
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Section – BCADS21
Roll Number – 1240258054

Submitted To:-
Mr. Ankit Verma

PROJECT

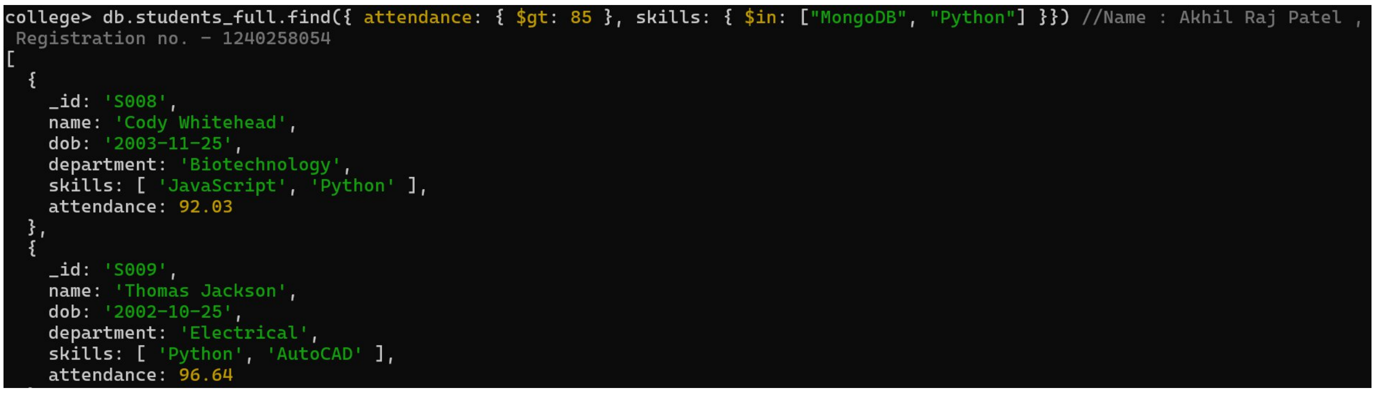
1. Complex Filters & Projections

Q1: - List the names and departments of students who have more than 85% attendance and are s skilled in both "MongoDB" and "Python".

Query: -

```
 db.students_full.find(
{ attendance: { $gt: 85 }, skills: { $in: ["MongoDB", "Python"] }})
```

Output: -



```
college> db.students_full.find({ attendance: { $gt: 85 }, skills: { $in: ["MongoDB", "Python"] }}) //Name : Akhil Raj Patel ,
 Registration no. - 1240258054
[
  {
    _id: 'S008',
    name: 'Cody Whitehead',
    dob: '2003-11-25',
    department: 'Biotechnology',
    skills: [ 'JavaScript', 'Python' ],
    attendance: 92.03
  },
  {
    _id: 'S009',
    name: 'Thomas Jackson',
    dob: '2002-10-25',
    department: 'Electrical',
    skills: [ 'Python', 'AutoCAD' ],
    attendance: 96.64
```

- Nothing will show up because there aren't any students who have both 'MongoDB' and 'Python' skills and more than 85% attendance.

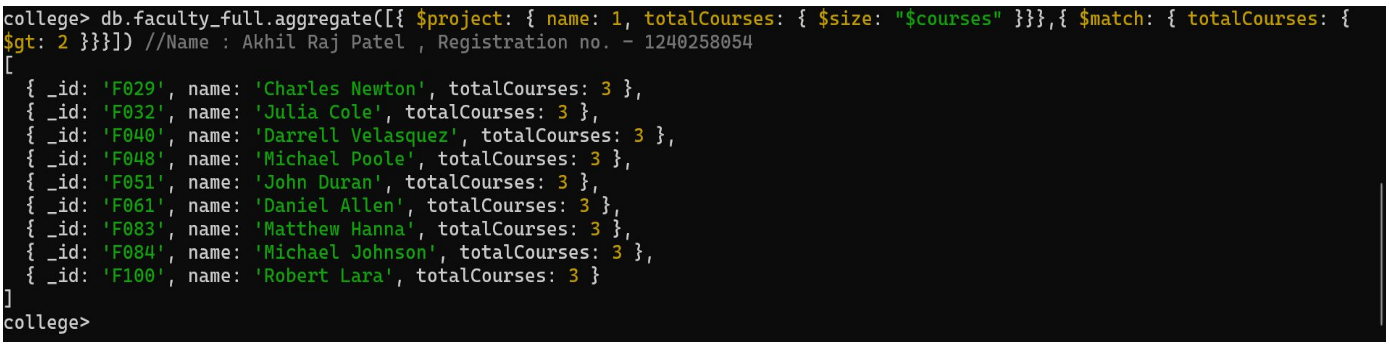
- Use **comparison operators** like $gt (greater than).
- Apply **array matching** with $all to ensure multiple elements exist.
- Use **projection** to show only required fields.
- Build **compound filters** using multiple conditions.

Q2: - Show all faculty who are teaching more than 2 courses. Display their names and the total number of courses they teach.

Query: -

```
db.faculty_full.aggregate(
[{ $project: { name: 1, totalCourses: { $size: "$courses" }}},
{ $match: { totalCourses: { $gt: 2 }}}])
```

Output: -



```
college> db.faculty_full.aggregate([{ $project: { name: 1, totalCourses: { $size: "$courses" }}},{ $match: { totalCourses: {
$gt: 2 }}}]) //Name : Akhil Raj Patel , Registration no. - 1240258054
[
  { _id: 'F029', name: 'Charles Newton', totalCourses: 3 },
  { _id: 'F032', name: 'Julia Cole', totalCourses: 3 },
  { _id: 'F040', name: 'Darrell Velasquez', totalCourses: 3 },
  { _id: 'F048', name: 'Michael Poole', totalCourses: 3 },
  { _id: 'F051', name: 'John Duran', totalCourses: 3 },
  { _id: 'F061', name: 'Daniel Allen', totalCourses: 3 },
  { _id: 'F083', name: 'Matthew Hanna', totalCourses: 3 },
  { _id: 'F084', name: 'Michael Johnson', totalCourses: 3 },
  { _id: 'F100', name: 'Robert Lara', totalCourses: 3 }
]
college>
```

- Use $project to create computed fields.
- Use $size to count array elements.
- Combine $match after projection for conditional filtering.
- Understand aggregation pipelines.

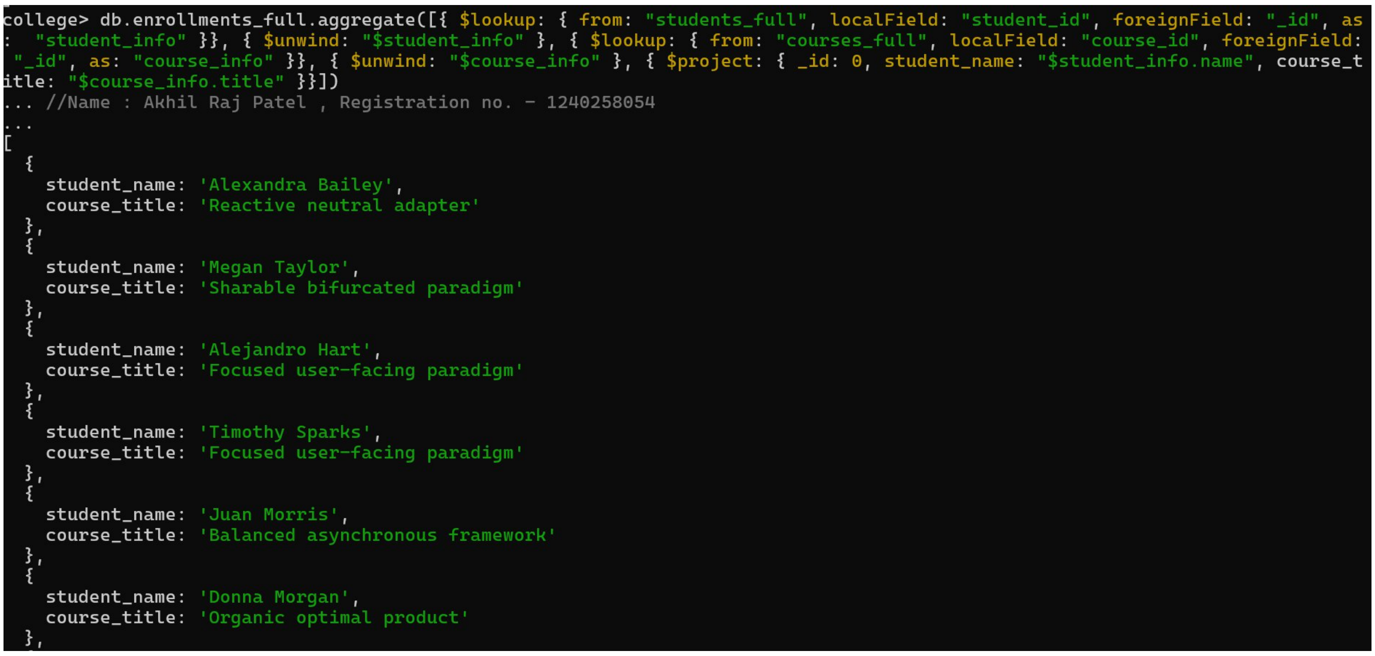
2. Joins ($lookup) and Aggregations

Q3: - Write a query to show each student's name along with the course titles they are enrolled in (use $lookup between enrollments, students, and courses).

Query: -

```
db.enrollments_full.aggregate(
[{ $lookup: { from: "students_full", localField: "student_id", foreignField: "_id",
      as:  "student_info" }},
{ $unwind: "$student_info" }, { $lookup: { from: "courses_full", localField: "course_id",
      foreignField: "_id", as: "course_info" }},
{ $unwind: "$course_info" }, { $project: { _id: 0, student_name: "$student_info.name",
      course_title: "$course_info.title" }}])
```

Output:-



```
college> db.enrollments_full.aggregate([{ $lookup: { from: "students_full", localField: "student_id", foreignField: "_id", as
:  "student_info" }}, { $unwind: "$student_info" }, { $lookup: { from: "courses_full", localField: "course_id", foreignField:
 "_id", as: "course_info" }}, { $unwind: "$course_info" }, { $project: { _id: 0, student_name: "$student_info.name", course_t
itle: "$course_info.title" }}])
... //Name : Akhil Raj Patel , Registration no. - 1240258054
...
[
  {
    student_name: 'Alexandra Bailey',
    course_title: 'Reactive neutral adapter'
  },
  {
    student_name: 'Megan Taylor',
    course_title: 'Sharable bifurcated paradigm'
  },
  {
    student_name: 'Alejandro Hart',
    course_title: 'Focused user-facing paradigm'
  },
  {
    student_name: 'Timothy Sparks',
    course_title: 'Focused user-facing paradigm'
  },
  {
    student_name: 'Juan Morris',
    course_title: 'Balanced asynchronous framework'
  },
  {
    student_name: 'Donna Morgan',
    course_title: 'Organic optimal product'
  },
```

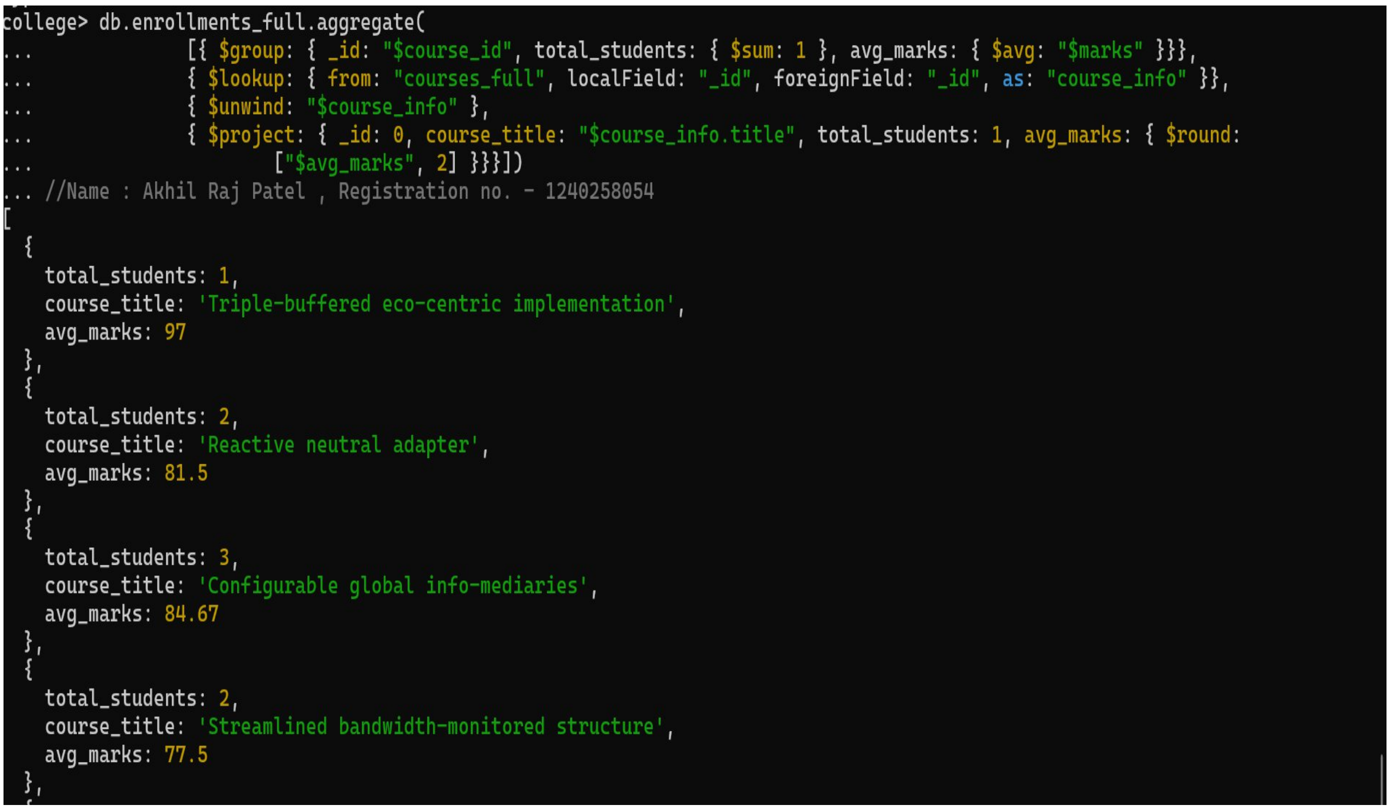
- Use $lookup for joins between collections.
- Combine multiple $lookups for complex relationships.
- Use $arrayElemAt to extract single values from arrays.
- Understand MongoDB's relational-like linking.

Q4: - For each course, display the course title, number of students enrolled, and average marks (use $group).

Query: -

db.enrollments_full.aggregate([{ $group: { _id: "$course_id", total_students: { $sum: 1 }, avg_marks: { $avg: "$marks" } }},
{ $lookup: { from: "courses_full", localField: "_id", foreignField: "_id", as: "course_info" }},
{ $unwind: "$course_info" },
{ $project: { _id: 0, course_title: "$course_info.title", total_students: 1, avg_marks: { $round: ["$avg_marks", 2] } }}])

Output:-



```
college> db.enrollments_full.aggregate(
...             [{ $group: { _id: "$course_id", total_students: { $sum: 1 }, avg_marks: { $avg: "$marks" } }},
...             { $lookup: { from: "courses_full", localField: "_id", foreignField: "_id", as: "course_info" }},
...             { $unwind: "$course_info" },
...             { $project: { _id: 0, course_title: "$course_info.title", total_students: 1, avg_marks: { $round:
...                     ["$avg_marks", 2] } }}])
... //Name : Akhil Raj Patel , Registration no. - 1240258054
[
  {
    total_students: 1,
    course_title: 'Triple-buffered eco-centric implementation',
    avg_marks: 97
  },
  {
    total_students: 2,
    course_title: 'Reactive neutral adapter',
    avg_marks: 81.5
  },
  {
    total_students: 3,
    course_title: 'Configurable global info-mediaries',
    avg_marks: 84.67
  },
  {
    total_students: 2,
    course_title: 'Streamlined bandwidth-monitored structure',
    avg_marks: 77.5
  },
```

- Use $group for summarizing data.
- Use $avg and $sum to calculate aggregates.
- $unwind helps to deconstruct arrays.
- $project to rename and structure output.

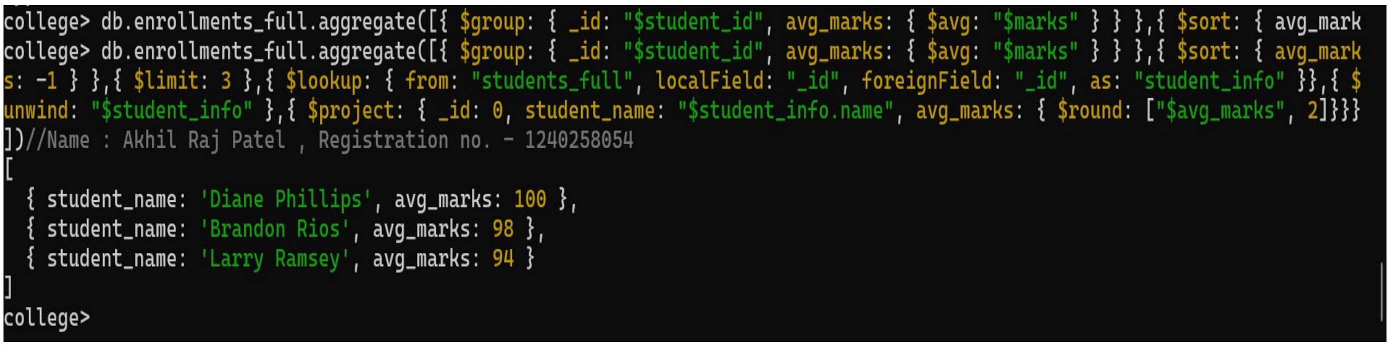
3. Grouping, Sorting, and Limiting

Q5: - Find the top 3 students with the highest average marks across all enrolled courses.

Query: -

```
db.enrollments_full.aggregate(
[{ $group: { _id: "$student_id", avg_marks: { $avg: "$marks" } } },
{ $sort: { avg_marks: -1 } },
{ $limit: 3 },
{ $lookup: { from: "students_full", localField: "_id", foreignField: "_id", as: "student_info" }},
{ $unwind: "$student_info" },
{ $project: { _id: 0, student_name: "$student_info.name", avg_marks: { $round: ["$avg_marks", 2]
        }}}])
```

Output:-



```
college> db.enrollments_full.aggregate([{ $group: { _id: "$student_id", avg_marks: { $avg: "$marks" } } },{ $sort: { avg_mark
college> db.enrollments_full.aggregate([{ $group: { _id: "$student_id", avg_marks: { $avg: "$marks" } } },{ $sort: { avg_mark
s: -1 } },{ $limit: 3 },{ $lookup: { from: "students_full", localField: "_id", foreignField: "_id", as: "student_info" }},{ $
unwind: "$student_info" },{ $project: { _id: 0, student_name: "$student_info.name", avg_marks: { $round: ["$avg_marks", 2]}}}
])//Name : Akhil Raj Patel , Registration no. - 1240258054
[
  { student_name: 'Diane Phillips', avg_marks: 100 },
  { student_name: 'Brandon Rios', avg_marks: 98 },
  { student_name: 'Larry Ramsey', avg_marks: 94 }
]
college>
```

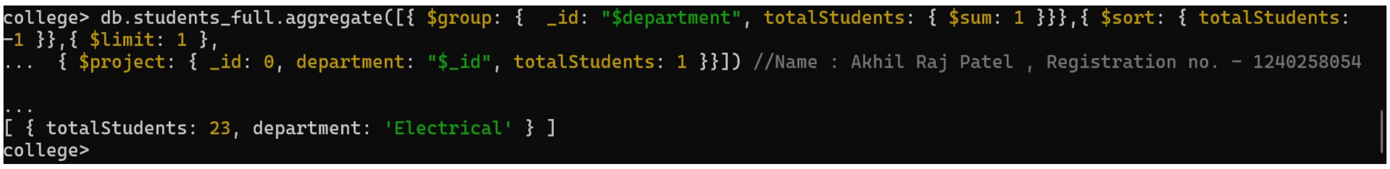
- $sort sorts data in ascending/descending order.
- $limit restricts results to top records.
- $group for calculating averages.
- Combining joins with grouping.

Q6: - Count how many students are in each department. Display the department with the highest number of students.

Query: -

```
db.students_full.aggregate(
[{ $group: {  _id: "$department", totalStudents: { $sum: 1 }}},
{ $sort: { totalStudents: -1 }},
{ $limit: 1 },
{ $project: { _id: 0, department: "$_id", totalStudents: 1 }}])
```

Output:-



```
college> db.students_full.aggregate([{ $group: {  _id: "$department", totalStudents: { $sum: 1 }}},{ $sort: { totalStudents: -1 }},{ $limit: 1 },
...   { $project: { _id: 0, department: "$_id", totalStudents: 1 }}]) //Name : Akhil Raj Patel , Registration no. - 1240258054
...
[ { totalStudents: 23, department: 'Electrical' } ]
college>
```

- Count items per category with $sum: 1.
- Use $sort to rank results.
- Identify top-performing or most populated groups.
- Apply $limit to get top results.

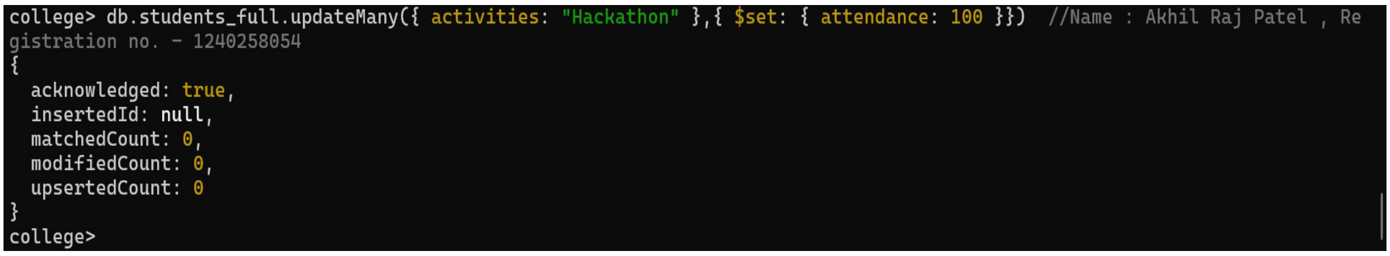
4. Update, Upsert, and Delete

Q7: - Update attendance to 100% for all students who won any "Hackathon".

Query: -

```
db.students_full.updateMany(
{ activities: "Hackathon" },
{ $set: { attendance: 100 }})
```

Output:-



```
college> db.students_full.updateMany({ activities: "Hackathon" },{ $set: { attendance: 100 }})  //Name : Akhil Raj Patel , Re
gistration no. - 1240258054
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 0,
  modifiedCount: 0,
  upsertedCount: 0
}
college>
```

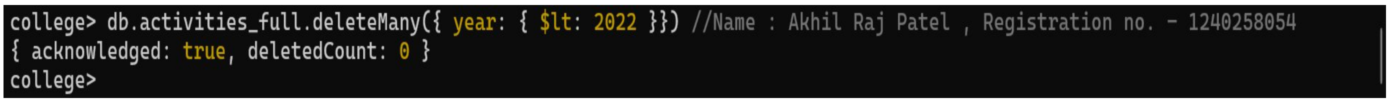
- Use updateMany() for bulk updates.
- $set modifies specific fields.
- Target documents via **nested fields**.
- Understand bulk updates with filters.

Q8: - Delete all student activity records where the activity year is before 2022.

Query: -

```
db.activities_full.deleteMany(
 { year: { $lt: 2022 }})
```

Output:-



```
college> db.activities_full.deleteMany({ year: { $lt: 2022 }}) //Name : Akhil Raj Patel , Registration no. - 1240258054
{ acknowledged: true, deletedCount: 0 }
college>
```

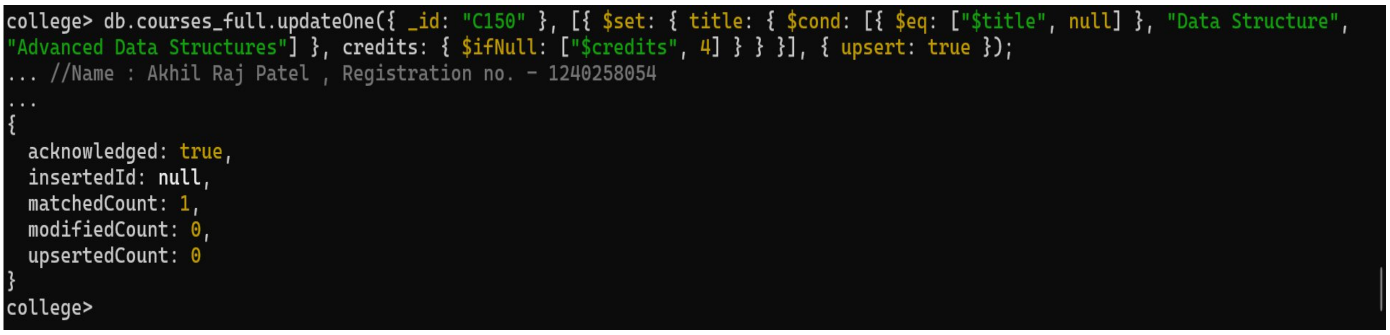
- Delete records conditionally using deleteMany().
- $lt filters by less than a value.
- Manage dataset cleanup.
- Apply conditional data management.

Q9: - Upsert a course record for "Data Structures" with ID "C150" and credits 4—if it doesn't exist, insert it; otherwise update its title to "Advanced Data Structures".

Query: -

```
db.courses_full.updateOne(
{ _id: "C150" },
[{ $set: { title: { $cond: [{ $eq: ["$title", null] }, "Data Structure", "Advanced Data Structures"]},
     credits: { $ifNull: ["$credits":  4]}}}],
{ upsert: true })
```

Output:-



```
college> db.courses_full.updateOne({ _id: "C150" }, [{ $set: { title: { $cond: [{ $eq: ["$title", null] }, "Data Structure",
"Advanced Data Structures"] }, credits: { $ifNull: ["$credits", 4] } } }], { upsert: true });
... //Name : Akhil Raj Patel , Registration no. - 1240258054
...
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 0,
  upsertedCount: 0
}
college>
```

- upsert: true inserts if no match is found.
- $setOnInsert applies only when inserting new data.
- $set updates fields if record exists.
- Handle both **insert and update** in one command.

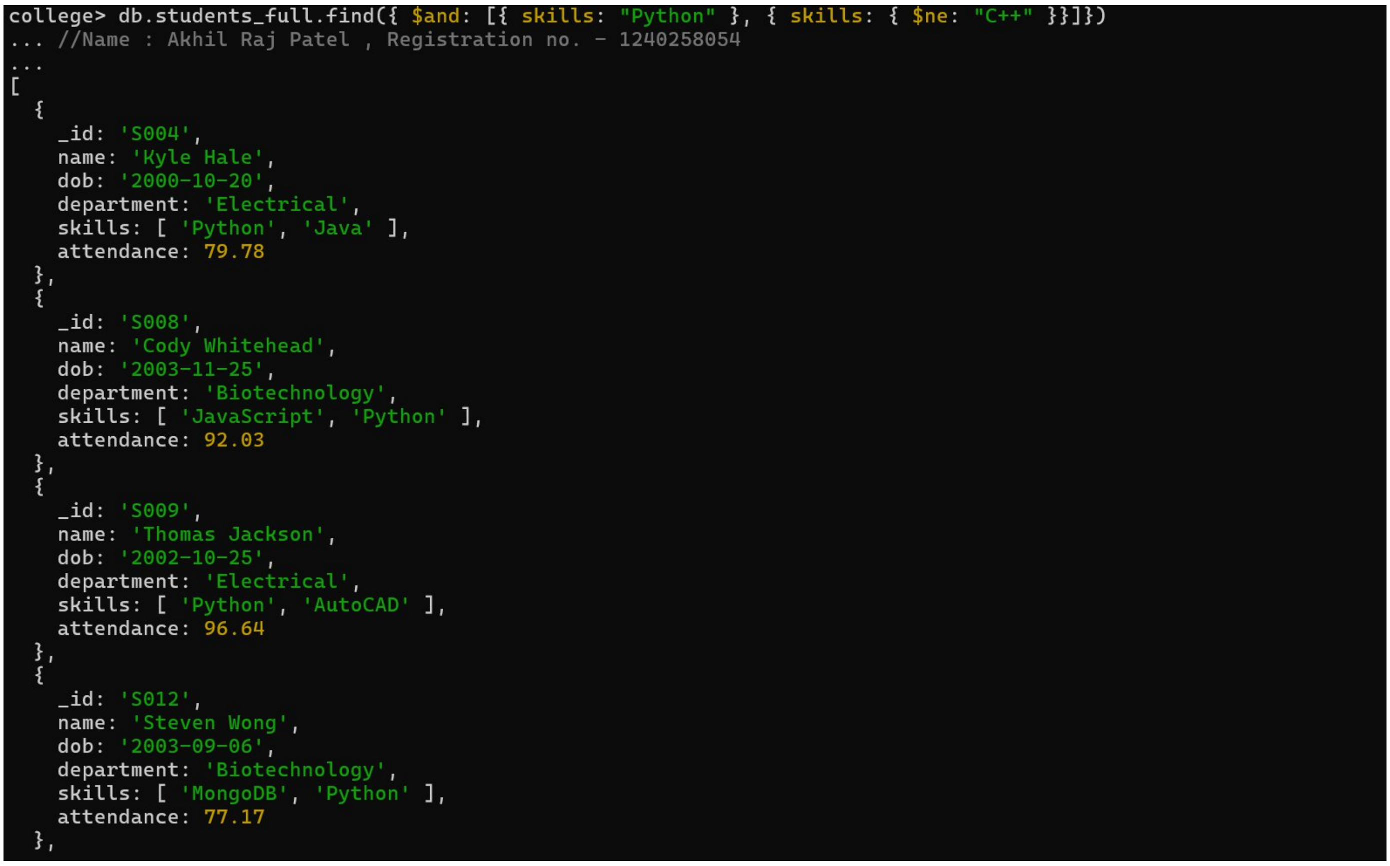
5. Array & Operator Usage

Q10: - Find all students who have "Python" as a skill but not "C++".

Query: -

```
db.students_full.find(
{ $and: [{ skills: "Python" }, { skills: { $ne: "C++" }}]})
```

Output:-



```
college> db.students_full.find({ $and: [{ skills: "Python" }, { skills: { $ne: "C++" }}]})
... //Name : Akhil Raj Patel , Registration no. - 1240258054
...
[
  {
    _id: 'S004',
    name: 'Kyle Hale',
    dob: '2000-10-20',
    department: 'Electrical',
    skills: [ 'Python', 'Java' ],
    attendance: 79.78
  },
  {
    _id: 'S008',
    name: 'Cody Whitehead',
    dob: '2003-11-25',
    department: 'Biotechnology',
    skills: [ 'JavaScript', 'Python' ],
    attendance: 92.03
  },
  {
    _id: 'S009',
    name: 'Thomas Jackson',
    dob: '2002-10-25',
    department: 'Electrical',
    skills: [ 'Python', 'AutoCAD' ],
    attendance: 96.64
  },
  {
    _id: 'S012',
    name: 'Steven Wong',
    dob: '2003-09-06',
    department: 'Biotechnology',
    skills: [ 'MongoDB', 'Python' ],
    attendance: 77.17
  },
```

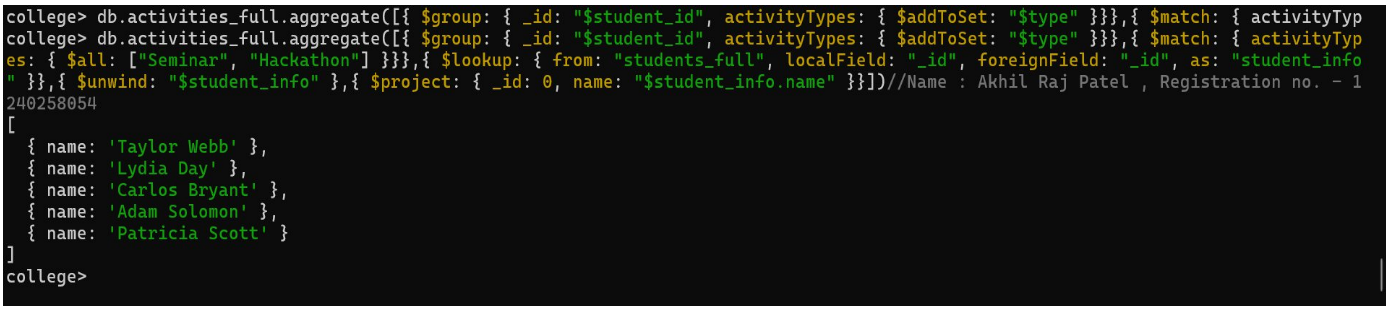
- $in checks for presence in arrays.
- $nin checks for absence in arrays.
- Combine both for exclusive conditions.
- Operate effectively on array fields.

Q11: - Return names of students who participated in "Seminar" and "Hackathon" both.

Query: -

```
db.activities_full.aggregate(
[{ $group: { _id: "$student_id", activityTypes: { $addToSet: "$type" }}},
{ $match: { activityTypes: { $all: ["Seminar", "Hackathon"] }}},
{ $lookup: { from: "students_full", localField: "_id", foreignField: "_id", as: "student_info" }},
{ $unwind: "$student_info" },
{ $project: { _id: 0, name: "$student_info.name" }}])
```

Output:-



```
college> db.activities_full.aggregate([{ $group: { _id: "$student_id", activityTypes: { $addToSet: "$type" }}},{ $match: { activityTyp
college> db.activities_full.aggregate([{ $group: { _id: "$student_id", activityTypes: { $addToSet: "$type" }}},{ $match: { activityTyp
es: { $all: ["Seminar", "Hackathon"] }}},{ $lookup: { from: "students_full", localField: "_id", foreignField: "_id", as: "student_info
" }},{ $unwind: "$student_info" },{ $project: { _id: 0, name: "$student_info.name" }}])//Name : Akhil Raj Patel , Registration no. - 1
240258054
[
  { name: 'Taylor Webb' },
  { name: 'Lydia Day' },
  { name: 'Carlos Bryant' },
  { name: 'Adam Solomon' },
  { name: 'Patricia Scott' }
]
college>
```

- $all ensures all specified elements exist in an array.
- Simple array querying in MongoDB.
- Combine multiple filters in a single query.
- Efficient participation tracking.

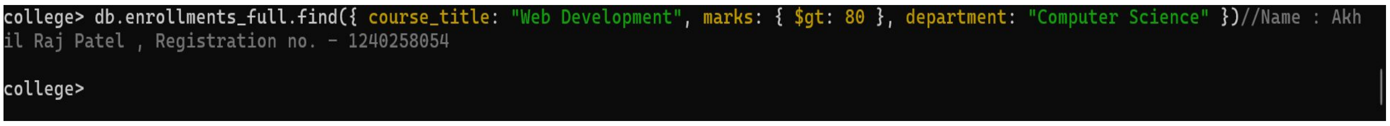
6. Subdocuments and Nested Conditions

Q12: - Find students who scored more than 80 in "Web Development" only if they belong to the "Computer Science" department.

Query: -

```
db.enrollments_full.find(
{ course_title: "Web Development", marks: { $gt: 80 }, department: "Computer Science" })
```

Output:-



```
college> db.enrollments_full.find({ course_title: "Web Development", marks: { $gt: 80 }, department: "Computer Science" })//Name : Akh
il Raj Patel , Registration no. - 1240258054

college>
```

- Nothing will show up because there are no students in the Computer Science department who scored more than 80 in 'Web Development'.

- Access nested fields using dot notation.
- Combine multiple field conditions.
- Query subdocuments efficiently.
- Focused filtering by department and performance.

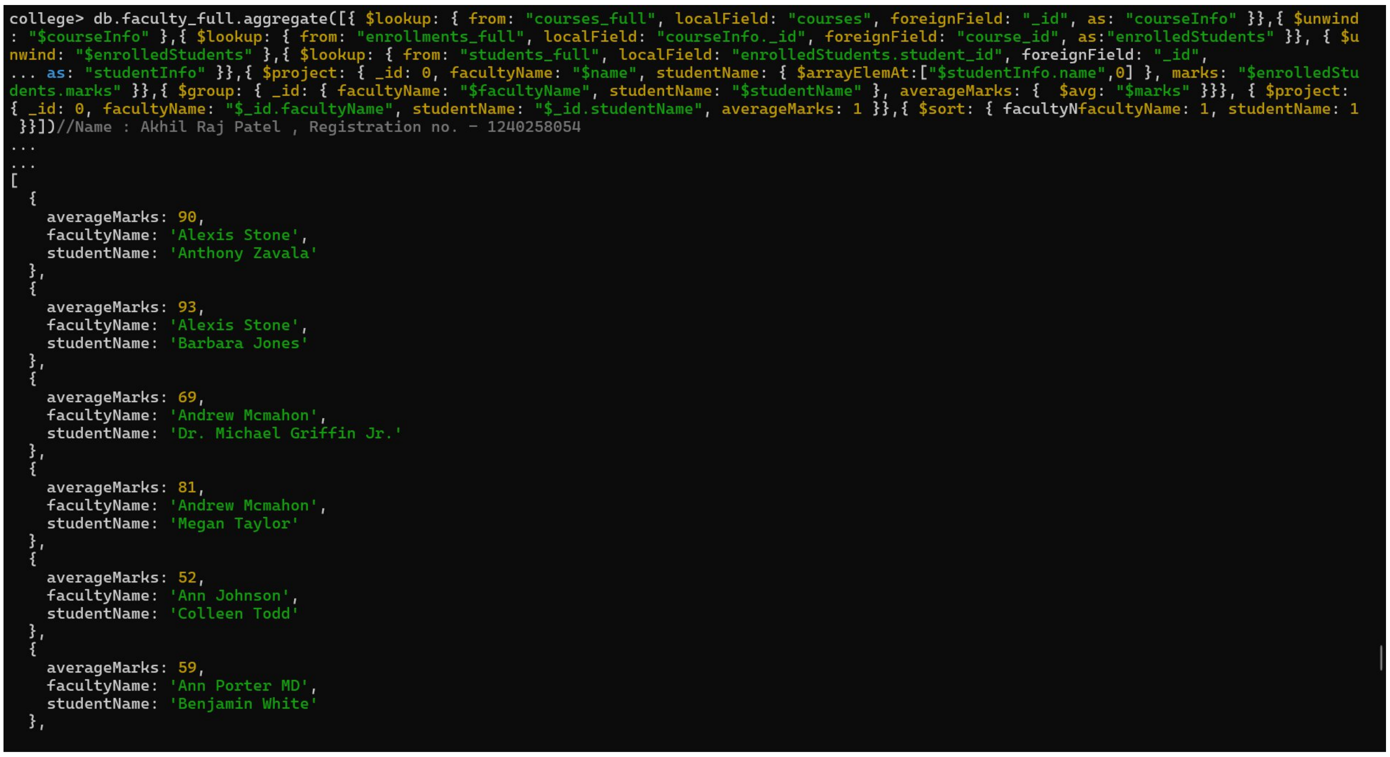
7. Advanced Aggregation (Challenge Level)

Q13: - For each faculty member, list the names of all students enrolled in their courses along with average marks per student per faculty.

Query: -

```
db.faculty_full.aggregate(
[{ $lookup: { from: "courses_full", localField: "courses", foreignField: "_id", as: "courseInfo" }},
{ $unwind: "$courseInfo" },
{ $lookup: { from: "enrollments_full", localField: "courseInfo._id", foreignField: "course_id", as:
        "enrolledStudents" }},
{ $unwind: "$enrolledStudents" },
{ $lookup: { from: "students_full", localField: "enrolledStudents.student_id", foreignField: "_id",
        as: "studentInfo" }},
{ $project: { _id: 0, facultyName: "$name", studentName: { $arrayElemAt:
        ["$studentInfo.name",0] }, marks: "$enrolledStudents.marks" }},
 { $group: { _id: { facultyName: "$facultyName", studentName: "$studentName" },
        averageMarks: {  $avg: "$marks" }}},
 { $project: { _id: 0, facultyName: "$_id.facultyName", studentName: "$_id.studentName",
        averageMarks: 1 }},
 { $sort: { facultyName: 1, studentName: 1 }}])
```

Output: -



```
college> db.faculty_full.aggregate([{ $lookup: { from: "courses_full", localField: "courses", foreignField: "_id", as: "courseInfo" }},{ $unwind
: "$courseInfo" },{ $lookup: { from: "enrollments_full", localField: "courseInfo._id", foreignField: "course_id", as:"enrolledStudents" }}, { $u
nwind: "$enrolledStudents" },{ $lookup: { from: "students_full", localField: "enrolledStudents.student_id", foreignField: "_id",
... as: "studentInfo" }},{ $project: { _id: 0, facultyName: "$name", studentName: { $arrayElemAt:["$studentInfo.name",0] }, marks: "$enrolledStu
dents.marks" }},{ $group: { _id: { facultyName: "$facultyName", studentName: "$studentName" }, averageMarks: {  $avg: "$marks" }}}, { $project:
{ _id: 0, facultyName: "$_id.facultyName", studentName: "$_id.studentName", averageMarks: 1 }},{ $sort: { facultyNfacultyName: 1, studentName: 1
 }}])//Name : Akhil Raj Patel , Registration no. - 1240258054
...
...
[
  {
    averageMarks: 90,
    facultyName: 'Alexis Stone',
    studentName: 'Anthony Zavala'
  },
  {
    averageMarks: 93,
    facultyName: 'Alexis Stone',
    studentName: 'Barbara Jones'
  },
  {
    averageMarks: 69,
    facultyName: 'Andrew Mcmahon',
    studentName: 'Dr. Michael Griffin Jr.'
  },
  {
    averageMarks: 81,
    facultyName: 'Andrew Mcmahon',
    studentName: 'Megan Taylor'
  },
  {
    averageMarks: 52,
    facultyName: 'Ann Johnson',
    studentName: 'Colleen Todd'
  },
  {
    averageMarks: 59,
    facultyName: 'Ann Porter MD',
    studentName: 'Benjamin White'
  },
```

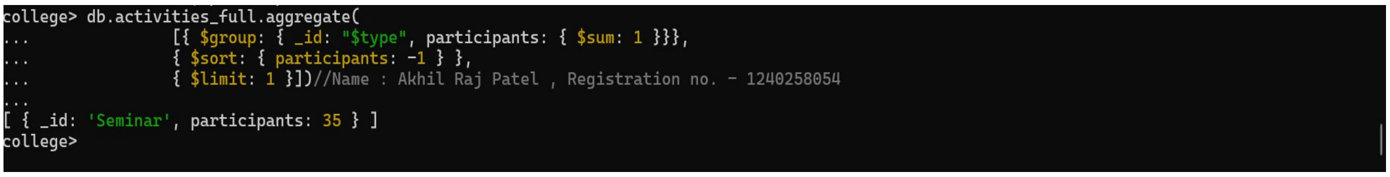
- Multi-level joins using $lookup.
- $addToSet to avoid duplicate student names.
- $avg to compute average marks per faculty.
- Real-world aggregation chaining.

Q14: - Show the most popular activity type (e.g., Hackathon, Seminar, etc.) by number of student participants.

Query: -

```
db.activities_full.aggregate(
[{ $group: { _id: "$type", participants: { $sum: 1 }}},
{ $sort: { participants: -1 } },
{ $limit: 1 }])
```

Output: -



```
college> db.activities_full.aggregate(
...             [{ $group: { _id: "$type", participants: { $sum: 1 }}},
...             { $sort: { participants: -1 } },
...             { $limit: 1 }])//Name : Akhil Raj Patel , Registration no. - 1240258054
...
[ { _id: 'Seminar', participants: 35 } ]
college>
```

- $unwind to count array elements.
- $group and $sum for totals.
- $sort to rank results.
- Identify “most popular” entities.